

CLAIMS

I claim:

1. A method of solution polymerizing an ion-triggerable cationic polymer comprising the steps of:

A. preparing a mixed solvent solution of water and acetone;

B. heating the solvent solution;

C. mixing with said solvent solution

1) one or more vinyl-functional cationic monomers,

2) one or more hydrophobic vinyl monomers having alkyl side chains of 1 to 4 carbon atoms,

3) optionally about 0% to 30 mole % of one or more other vinyl monomers with linear or branched alkyl groups longer than 4 carbons, alkyl hydroxy, polyoxyalkylene, or other functional group, and

4) a free radical initiator, to form a reaction mixture;

D. heating the reaction mixture for a sufficient amount of time to polymerize the monomers and provide the ion-triggerable cationic polymer;

E. after polymerization, performing the following steps in any sequence, including simultaneously, adding water to said reaction mixture to provide an aqueous dispersion of said ion-triggerable cationic polymer, and

F. removing substantially all of the acetone from said reaction mixture.

2. The method of claim 1 further including the step of removing oxygen from said solvent solution prior to forming said reaction mixture.

3. The method of claim 1 wherein the solvent solution is comprised of about 50% to about 90% by weight acetone and about 10% to about 50% by weight water.

4. The method of claim 1 wherein the solvent solution is comprised of 75% by weight acetone and 25% by weight water.

5. The method of claim 1 wherein the step of heating the solvent solution comprises heating the solvent solution to reflux prior to adding the vinyl-functional cationic monomer, the hydrophobic vinyl monomer, and the free radical initiator thereto to form said reaction mixture.

6. The method of claim 1 wherein said one or more vinyl-functional cationic monomers is added as an aqueous solution to said solvent solution.

7. The method of claim 1 wherein the vinyl-functional cationic monomer is selected from [2-(acryloxy)ethyl] dimethyl ammonium chloride, [2-(methacryloxy)ethyl] dimethyl ammonium chloride, [2-(acryloxy)ethyl] trimethyl ammonium chloride, [2-(methacryloxy)ethyl] trimethyl ammonium chloride, (3-acrylamidopropyl) trimethyl ammonium chloride, N,N-diallyldimethyl ammonium chloride, [2-(acryloxy)ethyl] dimethylbenzyl ammonium chloride, and [2-(methacryloxy)ethyl] dimethylbenzyl ammonium chloride.

8. The method of claim 1 wherein the vinyl-functional cationic monomer is selected from precursor monomers selected from vinylpyridine, dimethylaminoethyl acrylate and dimethylaminoethyl methacrylate followed by quaternization of the polymer.

9. The method of claim 1 wherein the vinyl-functional cationic monomer is selected from [2-(acryloxy)ethyl] dimethyl ammonium chloride, [2-(acryloxy)ethyl] dimethyl ammonium bromide, [2-(acryloxy)ethyl] dimethyl ammonium iodide, and [2-(acryloxy)ethyl] dimethyl ammonium methyl sulfate.

10. The method of claim 1 wherein the vinyl-functional cationic monomer is selected from [2-(methacryloxy)ethyl] dimethyl ammonium chloride, [2-(methacryloxy)ethyl] dimethyl ammonium bromide, [2-(methacryloxy)ethyl] dimethyl ammonium iodide, and [2-(methacryloxy)ethyl] dimethyl ammonium methyl sulfate.

11. The method of claim 1 wherein the vinyl-functional cationic monomer is selected from [2-(acryloxy)ethyl] trimethyl ammonium chloride, [2-

(acryloxy)ethyl] trimethyl ammonium bromide, [2-(acryloxy)ethyl] trimethyl ammonium iodide, and [2-(acryloxy)ethyl] trimethyl ammonium methyl sulfate.

12. The method of claim 1 wherein the vinyl-functional cationic monomer is selected from [2-(methacryloxy)ethyl] trimethyl ammonium chloride, [2-(methacryloxy)ethyl] trimethyl ammonium bromide, [2-(methacryloxy)ethyl] trimethyl ammonium iodide, and [2-(methacryloxy)ethyl] trimethyl ammonium methyl sulfate.

13. The method of claim 1 wherein the vinyl-functional cationic monomer is selected from (3-acrylamidopropyl) trimethyl ammonium chloride, (3-acrylamidopropyl) trimethyl ammonium bromide, (3-acrylamidopropyl) trimethyl ammonium iodide, and (3-acrylamidopropyl) trimethyl ammonium methyl sulfate.

14. The method of claim 1 wherein the vinyl-functional cationic monomer is selected from N,N-diallyldimethyl ammonium chloride, N,N-diallyldimethyl ammonium bromide, N,N-diallyldimethyl ammonium iodide, and N,N-diallyldimethyl ammonium methyl sulfate.

15. The method of claim 1 wherein the vinyl-functional cationic monomer is selected from [2-(acryloxy)ethyl] dimethylbenzyl ammonium chloride, [2-(acryloxy)ethyl] dimethylbenzyl ammonium bromide, [2-(acryloxy)ethyl] dimethylbenzyl ammonium iodide, and [2-(acryloxy)ethyl] dimethylbenzyl ammonium methyl sulfate.

16. The method of claim 1 wherein the vinyl-functional cationic monomer is selected from [2-(methacryloxy)ethyl] dimethylbenzyl ammonium chloride, [2-(methacryloxy)ethyl] dimethylbenzyl ammonium bromide, [2-(methacryloxy)ethyl] dimethylbenzyl ammonium iodide, and [2-(methacryloxy)ethyl] dimethylbenzyl ammonium methyl sulfate.

17. The method of claim 1 wherein the hydrophobic vinyl monomer is selected from branched or linear alkyl vinyl ethers, vinyl esters, acrylamides, and acrylates.

18. The method of claim 1 wherein the hydrophobic vinyl monomer is methyl acrylate.

19. The method of claim 1 wherein the vinyl-functional cationic polymer is [2-(acryloxy)ethyl] trimethyl ammonium chloride.

20. The method of claim 1 wherein the hydrophobic vinyl monomer is selected from the group consisting of methyl acrylate, ethyl acrylate, propyl acrylate and butyl acrylate.

21. The method of claim 1 wherein the free radical initiator is an azo initiator selected from the group consisting of 2,2'-azobisisobutyronitrile, 2,2'-azobis(2-methylbutyronitrile), 2,2'-azobis(2,4-dimethylvaleronitrile), and 2,2'-azobis(N,N'-dimethyleneisobutylamidine).

22. The method of claim 1 wherein the free radical initiator is a peroxide initiator selected from the group consisting of di(n-propyl)peroxydicarbonate, di(sec-butyl)peroxydicarbonate, di(2-ethylhexyl)peroxydicarbonate, t-amyl peroxyneodecanoate, t-butyl peroxyneodecanoate, t-amyl peroxy-pivalate, and t-butyl peroxy-pivalate.

23. The method of claim 1 further including preparing the mixed solvent solution of step A using the acetone removed after polymerization from step E, and thereafter repeating steps B through F.

24. The method of claim 23 further including adding an amount of make-up acetone to the acetone from step E when preparing the mixed solvent solution.